CLAIMS

What is claimed is:

1. A metal fuel cell system for providing backup power to one or more loads comprising:

one or more metal fuel cells, each comprising a power source and a fuel storage unit; and

a controller for sensing outage of primary power to the one or more loads, and, responsive thereto, operatively engaging the one or more fuel cells to provide power to the one or more loads.

2. The system of claim 1, wherein one or more of the metal fuel cells further comprises a regeneration unit.

3. The system of claim 1, wherein at least one of the power sources is configured to function as a regeneration unit.

4. The system of claim 1 wherein one or more of the metal fuel cells further comprises a reaction product storage unit.

5. The system of claim 4 wherein one or more of the metal fuel cells further comprises a second reactant storage unit.

6. The system of claim 1 further comprising a power conversion unit for converting the power output from the one or more fuel cells into another form.

7. The system of claim 6 wherein the power conversion unit is configured to convert DC power from the one or more fuel cells into AC power.

8. The system of claim 6 wherein the power conversion unit is configured to convert DC power from the one or more fuel cells into another form of DC power.

9. The system of claim 1 wherein the controller is configured to sense resumption of primary power to the one or more loads, and, responsive thereto, disengage the one or more fuel cells from providing power to the one or more loads.

10. The system of claim 2 or 3 wherein the controller is configured to sense resumption of delivery of primary power to the one or more loads, and,

responsive thereto, engage the primary power to provide power to one or more of the regeneration units in the one or more fuel cells.

11. The system of claim 1 wherein at least one of the one or more metal fuel cells is a zinc fuel cell.

12. The system of claim 1 wherein all of the one or more metal fuel cells are zinc fuel cells.

13. The system of claim 1 further comprising means for physically supporting the one or more fuel cells, and at least one of the one or more loads.

14. The system of claim 13 wherein the system further comprises a power conversion unit for converting the power output from the one or more fuel cells into another form, and the means for physically supporting the one or more fuel cells and at least one of the one or more loads further comprises means for physically supporting the controller, the power conversion unit, and the remainder of the one or more loads, and wherein the means integrally supports the system.

15. The system of any of claims 13 or 14 wherein the means is a rack.

16. The system of claim 1, wherein the system is configured to not utilize or produce significant quantities of flammable fuel or reactant product.

17. The system of claim 1, wherein the system is configured to provide backup power to the one or more loads for a time period in the range from about 0.01 hours to about 10,000 hours.

18. The system of claim 17, wherein the system is configured to provide backup power to the one or more loads for a time period in the range from about 0.5 hours to about 650 hours.

19. The system of claim 1, wherein the system is configured to have an energy density in the range from about 35 Watt-hours per kilogram of combined fuel and electrolyte added to the system to about 400 Watt-hours per kilogram of combined fuel and electrolyte added to the system.

20. The system of claim 1, wherein the system further comprises an energy requirement, and wherein the system is configured such that the combined volume of fuel and electrolyte added to the system is in the range from about 0.0028 L per Watt-

hour of the system's energy requirement to about 0.025 L per Watt-hour of the system's energy requirement.

21. The system of claim 20, wherein the energy requirement is in the range from about 50 Watt-hours to about 500,000 Watt-hours.

22. The system of claim 20, wherein the energy requirement is in the range from about 5 Watt-hours to about 5,000,000 Watt-hours.

23. The system of claim 1, wherein the fuel storage unit is configured to store fuel at a pressure in the range from about –5 psi to about 200 psi.

24. The system of claim 1, wherein at least one of the power sources comprises fuel that is present in cell cavities of the power source prior to operative engagement of the one or more fuel cells by the controller to provide power to the one or more loads.

25. The system of claim 24, wherein the amount of fuel present in the cell cavities of the power source prior to the controller sensing the outage of primary power to the one or more loads is sufficient to permit operative engagement of the one or more fuel cells by the controller to provide power to the one or more loads at a rate at least ten percent faster than when there is substantially no fuel present in the cell cavities of the power source prior to the controller sensing the outage.

26. The system of claim 24, wherein the amount of fuel present in the cell cavities of the at least one of the power sources prior to the controller sensing the outage of primary power to the one or more loads is sufficient to permit operative engagement of the one or more fuel cells by the controller for a time in the range of about 0.001 minutes to about 100 minutes without additional fuel being added.

27. The system of claim 24, wherein the at least one of the power sources further comprises one or more second reactants that are present in the power source at a pressure in the range from about 0.01 psi gauge pressure to about 200 psi gauge pressure prior to operative engagement of the one or more fuel cells by the controller to provide power to the one or more loads.

28. The system of claim 27, wherein the one or more second reactants are present in the power source at the pressure at a time prior to an outage sense time,

which outage sense time is in the range from about 10 microseconds to about 10 seconds after the controller has sensed outage of primary power to the one or more loads.

29. The system of claim 28, wherein the time is also after the controller has sensed outage of primary power to the one or more loads.

30. The system of claim 1, wherein the controller is configured to engage a flow of the one or more second reactants into the power source responsive to sensing the outage of primary power to the one or more loads.

31. The system of claim 1, wherein the system is configured to expel substantially no reaction products outside of the system.

32. The system of claim 5, wherein each of the fuel storage unit and the second reactant storage unit have an independently selected volume in the range from about 0.001 liters to about 1,000,000 liters.

33. A method of providing backup power to one or more loads comprising:

sensing an outage of primary power to the one or more loads; and

upon sensing an outage condition, operatively engaging one or more metal fuel cells to provide power to the one or more loads.

34. A method of providing backup power to one or more loads comprising, upon sensing an outage of primary power to the one or more loads, operatively engaging one or more metal fuel cells to provide power to the one or more loads.

35. The method of claim 32 or 33 further comprising converting the power output from the one or more fuel cells to another form.

36. The method of claim 34, wherein the power output from the one or more fuel cells is DC power, and the other form is AC power.

37. The method of claim 32 or 33 further comprising sensing resumption of primary power to the one or more loads, and, responsive thereto, disengaging the one or more fuel cells from providing power to the one or more loads.

38. The method of claim 32 or 33 further comprising sensing resumption of primary power to the one or more loads, and, responsive thereto, engaging the primary power to provide power to one or more regeneration unit(s) of the fuel cells.

39. The method of claim 32 or 33 wherein the one or more fuel cells are zinc fuel cells.

40. A method of pre-charging a fuel cell system for providing backup power to one or more loads comprising:

placing an amount of fuel in cell cavities of a power source of a fuel cell system prior to operative engagement of the fuel cell system.

41. The method of claim 39, wherein the amount of fuel is sufficient to operatively engage the fuel cell system for a time in the range from about 0.001 minutes to about 100 minutes without additional fuel being added thereto.

42. The method of claim 39, wherein the fuel is kept in the cell cavities for a time prior to operative engagement of the fuel cell system in the range from about 0.001 minutes to about 10 years.

43. A method of utilizing a pre-charged fuel cell system for providing backup power to one or more loads, comprising operatively engaging a fuel cell system, containing fuel in cell cavities of a power source of the fuel cell system prior to its operative engagement, for a time in the range from about 0.001 minutes to about 100 minutes without adding additional fuel thereto.